

## REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections contained in the Office Action of May 22, 2003 is respectfully requested.

Initially, it is noted that a number of minor editorial changes have been made to the specification and abstract for the sake of form. No new matter has been entered, however.

The Examiner's attention, furthermore, is directed to the accompanying Information Disclosure Statement.

The Examiner had rejected claims 1, 11-13 and 19-21 as being indefinite. The Examiner further rejected claims 1, 11-13 and 20-21 as being anticipated by Smalley, U.S. Patent 3,904,226. However, the Examiner went on to indicate that the subject matter of claim 19 would be allowable if redrafted into independent form and so as to address the formal rejection.

All Applicants thank the Examiner for the indication of allowable subject matter. It is nonetheless believed and submitted that the present invention as originally submitted clearly distinguishes over Smalley. The original claims have been cancelled, however, and replaced with new claims 22-50. Claims 22-42 correspond in substance to original claims 1-21, with claims 22, 32, 34, 35, 36, 33 and 42 corresponding to original claims 1, 11-13 and 19-21, respectively. Thus, these claims read upon the elected embodiment. Claims 43-50 are new claims all of which read upon the elected embodiment. The formal issues raised by the Examiner on page 2 of the Office Action, with respect to the claims, have been addressed in the redrafting of the claims. As such, it is respectfully submitted that all of the claims pending in the application are clearly definite, and indication of such is respectfully requested.

The Examiner had rejected at least claims 1, 11, 12 and 20-21 as being anticipated by Smalley. However, it is respectfully submitted to be clear that Smalley does not anticipate claim 22 or its dependent claims.

Claim 22 requires a fluid cylinder having a cylinder wall. Smalley has no fluid cylinder.  
Element number 6 is a tubular housing, and not a fluid cylinder.

Claim 22 further requires two pistons arranged so as to be linearly displaceable in the fluid cylinder. Smalley has no such fluid piston. Reference number 18 refers to a so-called restricting means. Reference number 10 refers to a so-called load transfer element. It is noted that load transfer element 10 is welded about its periphery to the interior of housing 6, i.e. it is fixed. Thus even if one could say that element number 10 was a piston, it is not a piston that is linearly displaceable in the fluid cylinder. In any case, neither the so-called restricting means 18 or the load transfer element 10 are a piston arranged in a fluid cylinder as that term is understood by those of ordinary skill in the art.

Claim 22 further requires an elastically deformable sealing member arranged between the two pistons so that when damping occurs by the piston rod displacing one of the two pistons in the fluid cylinder, the elastically deformable sealing member is squeezed between the two pistons and pressed against the cylinder wall. However, in Smalley, reference number 21 is in fact a bushing. It is noted that any damping that takes place with the arrangement of Smalley would solely be by the two bushings 21 and 22 themselves, and not due to any action in the tubular housing 6.

More specifically, as shown in the drawing figures, if adjusting part 12 is moved to the right then the bushing 21 is compressed between part 18 on the rod 12 and part 10 fixed in the tubular housing 6. If adjusting part 12 is moved to the left, then the bushing 22 is compressed between part 19a and 10. There is no fluid that is compressed and there is no friction taking place between the bushings 21 and 22 in tubular part 6.

For the above reasons, Smalley clearly does not disclose or suggest a fluid cylinder. Further, Smalley does not disclose or suggest two pistons arranged to be linearly displaceable in the fluid cylinder. Accordingly, it is respectfully submitted to be clear that claim 22 distinguishes over Smalley and indication of such is respectfully requested.

Claim 42 distinguishes over Smalley for the same reasons as are applicable with respect to claim 22. Furthermore, claim 42 requires that the fluid cylinder be mounted on a piece of furniture, which further distinguishes over Smalley.

Claim 43 is more specific to the elected embodiment. It distinguishes over Smalley for the same reasons as are discussed above. It further distinguishes over Smalley for a number of additional reasons, which are clear from the claim itself.

In view of all of the above, it is respectfully submitted that the present invention as now reflected by claims 22-50 distinguishes over Smalley. Indication of such is respectfully requested.

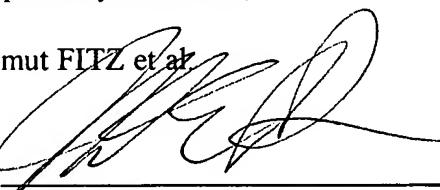
In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicants' undersigned representative.

Attached hereto is a marked-up version of the changes made to the specification and abstract by the current Amendment, captioned "Version with Markings to Show Changes Made".

Respectfully submitted,

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### Description

#### BACKGROUND OF THE INVENTION

The invention relates to a braking- and damping device, in particular for movable pieces of furniture, having a fluid-cylinder in which two pistons are arranged in a linearly displaceable manner, wherein a piston is displaceable over a piston rod.

With modern furniture, braking and damping devices are being used increasingly in order to prevent a door of a piece of furniture which is slammed shut too forcefully or a drawer which is pushed into a furniture frame with too much force from hitting the end wall of the furniture frame. The oldest damping devices were formed from simple rubber buffers. More recently, pneumatic and hydraulic braking- and damping devices have been used.

In the case of drawers, they are preferably combined with a drawing-in device. Also, doors or flaps are in many instances provided with hinges which have a closure mechanism, which is then responsible, together with the damping device, for an optimum course of movement.

In the case of fluid damping devices, i.e. pneumatic or hydraulic damping devices with a linearly movable piston, it has been seen that with high speeds or large volumes, the damping effect of the fluid is insufficient to brake the moving piece of furniture adequately.

US- Patent No. 4877226 therefore proposed a fluid damping device with a linearly movable piston wherein the piston radially expanded during the damping operation and pressed against the cylinder wall, so that in addition to the damping effect caused by the fluid, frictional damping occurred between the cylinder and piston.

#### SUMMARY OF THE INVENTION

The aim of the present invention is to create a pneumatic or hydraulic braking and damping device of the kind mentioned in the introduction, wherein improved sealing between the piston and cylinder wall is achieved, and wherein spring-back during braking by a cushion of air, or cushion of fluid, occurring in the cylinder is avoided.

The problem of the invention is solved in that an elastically deformable sealing member is arranged between the two pistons, which, when damping occurs, is deformed by being squeezed between the two pistons and pressed against the cylinder wall.

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Advantageously, it is provided that the piston, which is displaceable linearly by a piston rod, has an open cavity at the front face thereof into which a second piston is introduced. The second piston is mounted in the first piston in a freely displaceable manner, and, on the outer casing, has an annular projection which is disposed in front of the first piston. Arranged between the annular projection and the front face of the first piston is a sealing member, which is in the form of a sealing ring.

Advantageously, it is further provided that abutments are provided in the cavity of the first piston which delimit the path of displacement of the second piston.

One embodiment of the invention provides for at least one elastic spacer to be provided between the floor of the cavity of the first piston and the rear side of the second piston.

Another embodiment of the invention provides for the sealing member to be designed as a cylindrical solid body made from a rubber elastic material or as a cylindrical bellows. The cylindrical shape exists therein in the unloaded state. When loaded, the sealing member becomes compressed and deformed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

There will now follow a description of various embodiments of the invention with the aid of the accompanying drawings, wherein:

Figure 1 shows a longitudinal section through pistons and the cylinder of a braking and damping device according to the invention, in a ready position,

Figure 2 and Figure 3 each show a longitudinal section through the pistons and the cylinder of Figure 1, wherein the pistons are shown during a braking path,

Figure 4 shows a longitudinal section through the pistons and the cylinder, wherein the pistons are shown at an end of the braking path,

Figure 5 shows a longitudinal section through the pistons and the cylinder, wherein the pistons are shown in a restoring phase,

Figure 6 shows a longitudinal section through a cylinder piston unit according to another embodiment of the invention,

Figure 7 shows section A of Figure 6, wherein a piston is shown in a damping position,

Figure 8 shows section A of Figure 6, wherein another embodiment of a piston is shown in the damping position,

Figure 9 shows the same cut-out section as Figure 7, wherein the piston is shown in a ready, or restoring, position, and

Figure 10 shows the same cut-out section as Figure 8, wherein the piston is shown, once again, in the ready, or restoring, position.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A braking and damping device according to the invention has a cylinder 1 in which a piston 2 is arranged in a linearly displaceable manner. The piston 2 is provided with a piston rod 3. The piston rod 3 forms a plunger which is preferably acted upon by the movable piece of furniture. By way of example, the cylinder 1 maybe secured to the side wall of a piece of furniture, or to the top or floor of a piece of furniture, and in such a way that a closed door or end panel of a closed drawer abuts on the head 4 of the piston rod 3.

In the embodiment according to Figures 1 to 5, the piston 2 is provided with an open cavity 10 in the front face thereof, into which cavity a second piston 5 is inserted.

The first piston 2 has an annular projection 8, the inside of which acts as an abutment for delimiting the path of the second piston 5. During relative rearward movement of the piston 5, an abutment is formed by the floor 11 of the cavity 10 in the piston 2.

The piston 5 is likewise provided with an annular projection 16 which forms a counter-abutment which, when the piston 5 is disposed in the frontmost position in relation to the piston 2, rests upon the annular projection 8.

The piston 5 may be made of a plastics material, for example. Formed on the rear side of the piston 5 is at least one spacer 20 which bears in at least one recess 21 in the floor of the cavity 10 in the piston 2.

A front face 9 of the first piston 2 is inclined and extends radially outward inclined to the rear, as viewed with respect to the cylinder wall 7.

A ready position of the braking and damping device is shown in Figure 1. The pistons 2, 5 are disposed at the upper end of the cylinder 1. The term, "upper" is used here in relation to the drawings.

The piston 5 is held by the spacer 20 at a spacing from the floor 11 of the cavity 10. A sealing member, which is in the form of a sealing ring 6, is disposed with a certain clearance between the front face 9 of the piston 2 and an annular projection 22 of the piston 5. If a door of a piece of furniture or an end panel of a drawer strikes the head 4 of the piston rod 3, the pistons 2, 5 are pushed down in the cylinder, and, as can be seen from Figure 2, the spacer 20 is pushed down. When this happens, the sealing ring 6 is squeezed, deformed in cross-section, and pressed against the inner wall 7 of the cylinder 1.

The cylinder wall 7 is provided with axially extending ribs 15 which permit the passage of air when the piston 2 is disposed in the frontmost position. In so doing, the pistons 2, 5 become pressed apart by the spacer 20 (see Figure 4).

The piston 5 is provided with a skirt 19, consisting of a rubber-like or elastomer material, which preferably skims the inner wall 7 of the cylinder 2.

The cylinder 1 has air intake openings 23 on the rear side of the piston 2 and a return valve 12 with a discharge opening 13 on the front side. During damping, air is only able to escape slowly through the relatively small opening 13. When the pistons 2, 5 are withdrawn by the spring 14, i.e. are returned to the ready position, the return valve 12 opens and air, or another fluid, is able to flow unhindered into the cylinder 1.

In the embodiment shown, the second piston 5 is also provided with a cavity 25 which is open towards the front.

In the embodiments shown in Figures 6 to 10, an elastically deformable sealing member is also arranged between the pistons 2, 5.

In the embodiment according to Figures 7 and 9, the elastically deformable sealing member is formed by a solid body 18 consisting of rubberelastic material. This solid body 18 has projections 27 by means of which it is anchored in recesses 26 in the piston 2.

During the damping operation, i.e. when the piston 2 is being pressed into the cylinder 1 by the piston rod 3, the solid body 18, as shown in Figure 7, is compressed between the piston 2 and the piston 5 and pressed against the cylinder wall 7, whereby, in addition to the damping caused by the fluid, damping caused by friction takes place.

The piston 2 is provided with a seal 30 which bears against the cylinder wall 7. As a result, the resistance to fluid in the cylinder 1 is increased.

In the embodiment according to Figures 8 and 10, a bellows 17 is provided instead of a solid body 18. The bellows 17 has angled edges 28 by means of which it is anchored in slots 29 in the pistons 2, 5.

In the embodiment shown in Figures 6, 8 and 10, a compression spring 31 is provided between the pistons 2, 5 which pushes the pistons 2, 5 apart again after damping has occurred. A cavity 32 is surrounded by the bellows 17 and can contain a hydraulic fluid, e.g. oil. The outer side of the bellows 17 is provided with annular ribs 24 which improve adhesion of the bellows 27 to the cylinder wall 7.

During the damping process, the pistons 2, 5 are compressed, as shown in Figure 8, and the bellows 17 is pressed with greater intensity against the cylinder wall 7, giving rise to the effect of additional damping caused by friction.

The damping device according to the invention is preferably designed as a pneumatic damping device. However, it could also be implemented in the form of a hydraulic damping device.

#### Abstract

A braking and damping device for movable pieces of furniture has a fluid-cylinder (1) in which two pistons (2, 5) are arranged in a linearly displaceable manner. One of the pistons (2) is displaceable by a piston rod (3). Arranged between the two pistons (2, 5) is an elastically deformable sealing member, which, when damping occurs, is deformed by being squeezed between the two pistons (2, 5) and pressed against a cylinder wall (7).

## Description

BACKGROUND OF THE INVENTION

The invention relates to a braking- and damping device, in particular for movable pieces of furniture, having a fluid-cylinder in which two pistons are arranged in a linearly displaceable manner, wherein a piston is displaceable over a piston rod.

With modern furniture, braking- and damping devices are being used increasingly in order to prevent a door of a piece of furniture which is slammed shut too forcefully or a drawer which is pushed into a furniture frame with too much force from hitting the end wall of the furniture frame. The oldest damping devices were formed from simple rubber buffers. More recently, pneumatic and hydraulic braking- and damping devices have been used.

In the case of drawers, they are preferably combined with a drawing-in device. Also, doors or flaps are in many instances provided with hinges which have a closure mechanism, which is are then responsible, together with the damping device, for an optimum course of movement.

In the case of fluid damping devices, i.e. pneumatic or hydraulic damping devices with a linearly movable piston, it has been seen that with high speeds or large volumes, the damping effect of the fluid is insufficient to brake the moving piece of furniture adequately.

US-PS Patent No. 4877226 therefore proposed a fluid damping device with a linearly movable piston wherein which the piston radially expanded during the damping operation and pressed against the cylinder wall, so that in addition to the damping effect caused by the fluid, frictional damping occurred between the cylinder and piston.

SUMMARY OF THE INVENTION

The aim of the present invention is to create a pneumatic or hydraulic braking- and damping device of the kind mentioned in the introduction, wherein improved sealing between the piston and cylinder wall is achieved, and wherein spring-back during braking by a the cushion of air, or cushion of fluid, occurring in the cylinder is avoided.

The problem of the invention is solved in that an elastically deformable sealing member is arranged between the two pistons ~~is an elastically deformable sealing member~~, which, when

damping occurs, is deformed by being squeezed between the two pistons and pressed against the cylinder wall.

Advantageously, it is provided that the piston, which is displaceable linearly by ~~over~~ a piston rod, has an open cavity at the front face thereof into which a ~~the~~ second piston is introduced, ~~wherein the~~ The second piston is mounted in the first piston in a ~~a~~ freely displaceable manner, and, on the outer casing, has an annular projection which is disposed in front of the first piston, ~~and arranged~~ Arranged between the annular projection and the front face of the first piston is a ~~the~~ sealing member, which is in the form of a sealing ring.

Advantageously, it is further provided that abutments ~~are~~ provided in the cavity of the first piston ~~are abutments~~ which delimit the path of displacement of the second piston.

One embodiment of the invention provides for at least one elastic spacer to be provided between the floor of the cavity of the first piston and the rear side of the second piston.

Another embodiment of the invention provides for the sealing member to be designed as a cylindrical solid body made from a rubber elastic material or as a cylindrical bellows. The cylindrical shape exists therein in the unloaded state. When loaded, the sealing member becomes compressed and deformed.

#### BRIEF DESCRIPTION OF THE DRAWINGS

There will now follow a description of various embodiments of the invention with the aid of the accompanying drawings, wherein:

Figure 1 shows a longitudinal section through ~~the~~ the piston pistons and the cylinder of a braking- and damping device according to the invention, in a ~~the~~ ready position,

Figure 2 and Figure 3 each shows a longitudinal section through the ~~pistons~~ pistons and the cylinder of Figure 1, wherein the pistons are shown during a ~~the~~ braking path, and

Figure 4 shows a longitudinal section through the pistons and the cylinder, wherein the pistons are shown at an ~~the~~ end of the braking path,

Figure 5 shows a longitudinal section through the pistons and the cylinder, wherein the pistons are shown in a ~~the~~ restoring phase,

Figure 6 shows a longitudinal section through a cylinder piston unit according to another embodiment of the invention,

Figure 7 shows section A of Figure 6, wherein ~~a~~ the piston is shown in ~~a~~ the damping position,

Figure 8 shows section A of Figure 6, wherein another embodiment of a piston is shown in the damping position,

Figure 9 shows the same cut-out section as Figure 7, wherein the piston is shown in ~~a~~ the ready-, or restoring, position, and

Figure 10 shows the same cut-out section as Figure 8, wherein the piston is shown, once again, in the ready-, or restoring, position.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A. The braking- and damping device according to the invention has a cylinder 1 in which a piston 2 is arranged in ~~a~~ linearly displaceable manner. Therein, ~~the~~ The piston 2 is provided with a piston rod 3. The piston rod 3 forms a plunger which is preferably acted upon by the movable piece of furniture. By way of example, the cylinder 1 ~~maybe~~ is secured to the side wall ~~of~~ or a piece of furniture, or to the top or floor of a piece of furniture, and in such a way that a closed door or end panel of a closed drawer abuts on the head 4 of the piston rod 3.

In the embodiment according to Figures 1 to 5, the piston 2 is provided with an open cavity 10 in the front face thereof, into which cavity a second piston 5 is inserted.

The first piston 2 has an annular projection 8, ~~on~~ the inside of which acts as an abutment for delimiting the path of the second piston 5. During the relative rearward movement of the piston 5, ~~an~~ the abutment is formed by the floor 11 of the cavity 10 in the piston 2.

The piston 5 is likewise provided with an annular projection 16 which forms a counter-abutment, ~~and~~ which, when the piston 5 is disposed in the frontmost position in relation to the piston 2, rests upon the annular projection 8.

The piston 5 may be made of a plastics material, for example, ~~and~~ formed ~~on~~ the rear side of the piston 5 is at least one spacer 20 which bears in at least one recess 21 in the floor of the cavity 10 in the piston 2.

A The front face 9 of the first piston 2 is inclined and extends radially outward from the centre of the pistons 2, 5, inclinedly inclined to the rear, as viewed with respect to the cylinder wall 7.

A The ready position of the braking- and damping device is shown in Figure 1. The pistons 2, 5 are disposed at the upper end of the cylinder 1.

The term, "upper" is used here in relation to the drawings.

The piston 5 is held by the spacer 20 at a spacing from the floor 11 of the cavity 10, and the sealing member, which is in the form of a sealing ring 6, is disposed with a certain clearance between the front face 9 of the piston 2 and an annular projection 22 of the piston 5. If a door of a piece of furniture or an end panel of a drawer strikes the head 4 of the piston rod 3, the pistons 2, 5 are pushed down in the cylinder, and, as can be seen from Figure 2, the spacer 20 is pushed down.

When this happens, the sealing ring 6 is squeezed, deformed in cross-section, and pressed against the inner wall 7 of the cylinder 1.

The cylinder wall 7 is provided with axially extending ribs 15 which permit the passage of air when the piston 2 is disposed in the frontmost position.

In so doing, the pistons 2, 5 become are pressed apart by the spacer 20 (see Figure 4).

The piston 5 is provided with a skirt 19, consisting of a rubber-like or elastomer material, which preferably skims the inner wall 7 of the cylinder 2.

On the rear side of the piston 2, the cylinder 1 has air intake openings 23; on the rear side of the piston 2 and on the front side a return valve 12 with a discharge opening 13 on the front side.

During damping, air is only able to escape slowly through the relatively small opening 13.

When the pistons 2, 5 are withdrawn by the spring 14, i.e. are returned to the ready position, the return valve 12 opens and air, or another fluid, is able to flow unhindered into the cylinder 1.

In the embodiment shown, the second piston 5 is also provided with a cavity 25 which is open towards the front.

In the embodiments shown in Figures 6 to 10, an elastically deformable sealing member is also arranged between the pistons 2, 5.

In the embodiment according to Figures 7 and 9, the elastically deformable sealing member is formed by a solid body 18 consisting of rubber-elastic material. This solid body 18 has projections 27 by means of which it is anchored in recesses 26 in the piston 2.

During the damping operation, i.e. when the piston 2 is being pressed into the cylinder 1 by over the piston rod 3, the solid body 18, as shown in Figure 7, is compressed between the piston 2 and the piston 5 and pressed against the cylinder wall 7, whereby, in addition to the damping caused by the fluid, damping caused by friction takes place.

The piston 2 is provided with a seal 30 which bears against the cylinder wall 7. As a result, the resistance to fluid in the cylinder 1 is increased.

In the embodiment according to Figures 8 and 10, a bellows 17 is provided instead of a solid body 18.

The bellows 17 has angled edges 28 by means of which it is anchored in slots 29 in the pistons 2, 5.

In the embodiment shown in Figures 6, 8 and 10, a compression spring 31 is provided between the pistons 2, 5 which pushes the pistons 2, 5 apart again after damping has occurred.

A The cavity 32 is surrounded by the bellows 17 and can contain a hydraulic fluid, e.g. oil.

The outer side of the bellows 17 is provided with annular ribs 24 which improve adhesion of the bellows 27 to the cylinder wall 7.

During the damping process, the pistons 2, 5 are compressed, as shown in Figure 8-10, and the bellows 17 is pressed with greater intensity against the cylinder wall 7, giving rise to the effect of additional damping caused by friction.

The damping device according to the invention is preferably designed as a pneumatic damping device, e.g. a damping device. However, it could also be implemented in the form of a hydraulic damping device.

#### Abstract

A braking- and damping device, in particular for movable pieces of furniture, has having a fluid-cylinder (1) in which two pistons (2, 5) are arranged in a linearly displaceable manner. A piston One of the pistons (2) is displaceable by over a piston rod (3). Arranged between the two pistons (2, 5) is an elastically deformable sealing member, which, when damping occurs, is deformed by being squeezed between the two pistons (2, 5) and pressed against a the cylinder wall (7).

(Figure 2)